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technology.

+ Datasheet MOP301

Digital Moisture in Oil Immersion Probe
up to 120 °C (248 °F)



MOP301

Digital Moisture in Oil Immersion Probe up to 120 °C (248 °F)

The MOP301 reliably measures the moisture in transformer, lubrication or hydraulic oil as well as in diesel fuel. It is ideal for the preventive maintenance of equipment and machinery. Besides the accurate measurement of water activity (aw) and temperature (T), the MOP301 calculates the absolute water content of the oil (x) in ppm. The dynamic calculation is based on oil-specific solubility parameters.

Measurement Performance

The probe employs high end E+E humidity sensing elements with outstanding long term stability and high resistance to pollution.

Versatility

Various cable and probe lengths, together with the sliding fitting facilitate the MOP301 installation. Using the optional ball valve, the probe can be mounted or removed without process interruption.

RS485 Interface

The measured data is available on the RS485 interface with Modbus RTU protocol. The oil resistant cable with moulded M12 connector assures reliable data transmission even in harsh and aggressive environment.

Configurable and Adjustable

The free PCS10 Product Configuration Software and the optional adapter facilitate the setup and adjustment of the MOP301.



MOP301 with ball valve G 1/2" ISO



MOP301 pressure tight probe with sliding fitting

Features



Measurement Performance

- High measurement accuracy:
 - Water activity a_w
 - Temperature T
- Suitable for transformer, lubrication and hydraulic oil
- Calculation of water content x [ppm]
- Temperature range: -40...+120 °C (-40...+248 °F)
- Temperature compensation



Interface and Connection

- RS485 with Modbus RTU
- Oil resistant cable
- Moulded M12x1 connector

Mechanical Construction

- Stainless steel enclosure and filter cap
- Pressure tight up to 20 bar
- Process connection with ISO or NPT sliding fitting
- IP66 rating

Inspection certificate

According to DIN EN 10204-3.1

Features

Measurement of water activity a_w / water content x

The moisture in oil can be expressed in absolute or relative terms.

- **Water activity a_w** is the relative measure for moisture in oil. It represents the ratio between the actual amount of dissolved water and the maximum possible amount of dissolved water in the oil at a certain temperature. Independently of the oil type, the water activity shows how close to saturation the oil is at any moment in time. $a_w = 0$ indicates completely dry oil, while $a_w = 1$ fully saturated oil. MOP301 measures the water activity directly.
- The **water content x** is an absolute measure for the amount of water in the oil (dissolved, emulsified or separated). The water content is usually expressed in ppm or mg water/kg oil and it is independent from the oil temperature. For assessing the degree of saturation, x must be regarded together with T . MOP301 calculates x based on the measured a_w and T values. The calculation is oil dependent and requires a set of oil specific parameters. E+E offers the service of determining the oil specific parameters, see section “Ordering Guide” below. The parameters can be set upon order or uploaded to MOP301 using the PCS10 Product Configuration Software.

Sensor Leads Protection

In certain applications, the oil can become corrosive over time, for example due to continuous contamination of lubricating oils by salt water in the maritime environment. In such demanding applications, the E+E proprietary protection of the sensing element leads can significantly extend the service life of the sensor.

E+E Modular Sensor Platform

The MOP301 is compatible with the Sigma 05 host device of the E+E Modular Sensor Platform. Together they become a versatile, plug-and-play a_w/x modular sensor with analogue outputs and optional display. Besides MOP301, Sigma 05 accommodates also other E+E intelligent sensing probes. See www.epluse.com/sigma05 for further details.



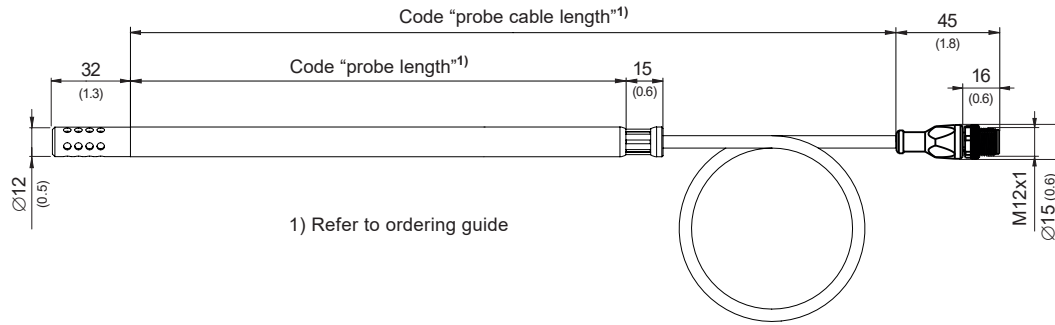
Sigma 05 with MOP301

Dimensions

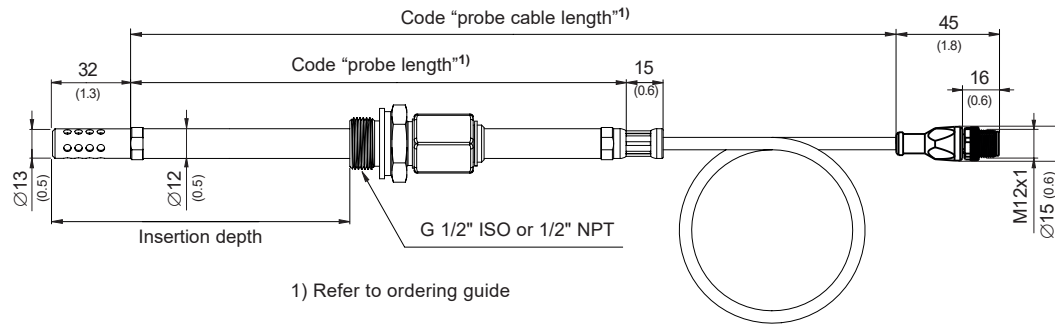
Values in mm (inch)

Types

Type T4



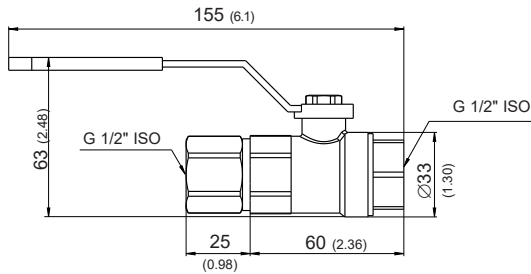
Type T10, 20 bar



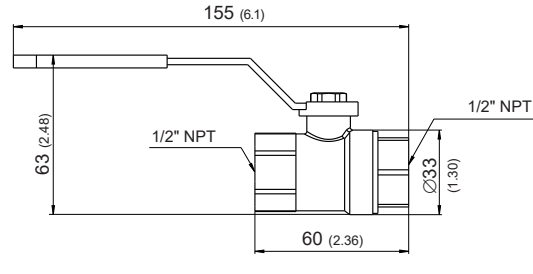
Probe length [mm (inch)]	Min. insertion depth [mm (inch)]	Max. insertion depth [mm (inch)]
200 (7.9)	23 (0.9)	167 (6.6)
400 (15.7)	23 (0.9)	367 (14.4)

Ball valve

G 1/2" ISO



1/2" NPT



Technical Data

Measurands

Water activity (aw) / water content (x)

Measuring range	0...1 aw 0...100000 ppm; actual range depends on the oil type, for non-mineral transformer oil, specific solubility parameters are needed (ppm output is valid in the range 0...100 °C (32...212 °F))
Accuracy¹⁾ including hysteresis, non-linearity and repeatability 0...40 °C (32...104 °F) (0...0.9 aw) -40...+120 °C (-40...+356 °F) (0...1 aw)	± 0.02 aw ± 0.025 aw ± 0.03 aw
Response time t_{90}, typ. @ 20 °C (68 °F) in still oil	10 min.
Resolution	0.0001 aw

1) Traceable to international standards, administrated by NIST, PTB, BEV...
The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor $k=2$ (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Temperature (T)

Measuring range	-40...+120 °C
Accuracy¹⁾	
Resolution	0.01 °C

1) Traceable to international standards, administrated by NIST, PTB, BEV...
The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor $k=2$ (2-times standard deviation).
The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).




Technical Data

Output

Digital

Digital interface	RS485 (MOP301 = 1 unit load)
Protocol Factory settings Supported Baud rates Measured data types	Modbus RTU 9 600 Baud, parity even, 1 stop bit, Modbus address 70 9 600, 19 200, 38 400, 57 600, 76 800 und 115 200 FLOAT32 and INT16

General

Power supply class III  USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	8 - 35 V DC
Power consumption , typ. without termination resistor	40 mW
Electrical connection	M12x1, 4 poles
Pressure rating	20 bar (290 psi)
Temperature working range Sensing element + filter cap Probe Cable M12 connector	-40...+125 °C (-40...+257 °F) -40...+120 °C (-40...+248 °F) -40...+120 °C (-40...+248 °F) -25...+90 °C (-13...+194 °F)
Storage conditions	-40...+80 °C (-40...+176 °F) 0...95 %RH, non-condensing
Material Cable jacket¹⁾ Probe	HFS 125XL, black, oil and fuel resistant Stainless steel 1.4404
Protection rating	IP66 / NEMA 4X
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 Industrial Environment FCC Part15 Class B ICES-003 Class B
Shock and vibration	Tested acc. to EN 60068-2-6 and EN 60068-2-27
Conformity	 
Configuration and adjustment	PCS10 Product Configuration Software (free download) and configuration adapter

1) Please mind the mounting and installing instructions included in the user manual.

Ordering Guide

Positon 1: Probe

Feature	Description	Code		
Configuration		MOP301-		
	Type	Probe up to 120 °C (248 °F)	T4	
		Remote probe with sliding fitting, pressure tight up to 20 bar (290 psi) and 120 °C (248°F)		T10
	Filter	Stainless steel, for flow <1 m/s (3.3 ft/s)	F13	
		Stainless steel, for flow >1 m/s (3.3 ft/s)	F18	
	Probe Cable Length	2 m (6.6 ft)	K2	
		5 m (16.4 ft)	K5	
		10 m (32.8 ft)	K10	
	Probe length	200 mm (7.87")	L200	
		400 mm (15.75")	L400	
Process connection	G 1/2" ISO - sliding fitting, Ø13 mm (0.51")		PA23	
	1/2" NPT - sliding fitting, Ø13 mm (0.51")		PA25	
Sensing element protection	Without	C0		
	Sensor leads protection	C2		
Oil parameterization for water content calculation	Mineral transformer oil	No code		
	Customer specific oil	PPMxxx¹⁾		

1) Positon 2: Procedure for customer specific oil

Option	Description	Code
Oil number is known	Replace the xxx by the corresponding number	
Obtaining new oil parameters via oil analysis	Contact and provide E+E HQ the datasheet of the oil before sending us 2 litres of oil. After determination of the oil specific parameters, the corresponding oil number is available, insert this in place of the xxx.	Oil-ppmcal
Obtaining new oil parameters via saturation curve	Contact and provide E+E HQ the datasheet of the oil together with the saturation curve. After calculation of the oil specific parameters, the corresponding oil number is available, insert this in place of the xxx.	Oil-calc

Order Example

Position 1: MOP301-T10F13K2L200PA23C0

Feature	Code	Description
Type	T10	Remote probe with sliding fitting, pressure tight up to 20 bar (290 psi) and 120 °C (248°F)
Filter	F13	Stainless steel, for flow <1 m/s
Cable length	K2	2 m (6.6 ft)
Probe length	L200	200 mm (7.9")
Process connection	PA23	G 1/2" ISO - sliding fitting, Ø13 mm (0.51")
Sensing element protection	C0	Without coating
Oil parameterization	No code	Mineral transformer oil

Order Example

Positon 1: MOP301-T10F13K2L200PA23C0PPMxxx

Feature	Code	Description
Type	T10	Remote probe with sliding fitting, pressure tight up to 20 bar (290 psi) and 120 °C (248°F)
Filter	F13	Stainless steel, for flow < 1 m/s
Probe cable length	K2	2 m (6.6 ft)
Probe length	L200	200 mm (7.9")
Process connection	PA23	G 1/2" ISO - sliding fitting, Ø13 mm (0.51")
Sensing element protection	C0	Without
Oil parameterization	PPMxxx	Customer specific oil, oil parameters unknown

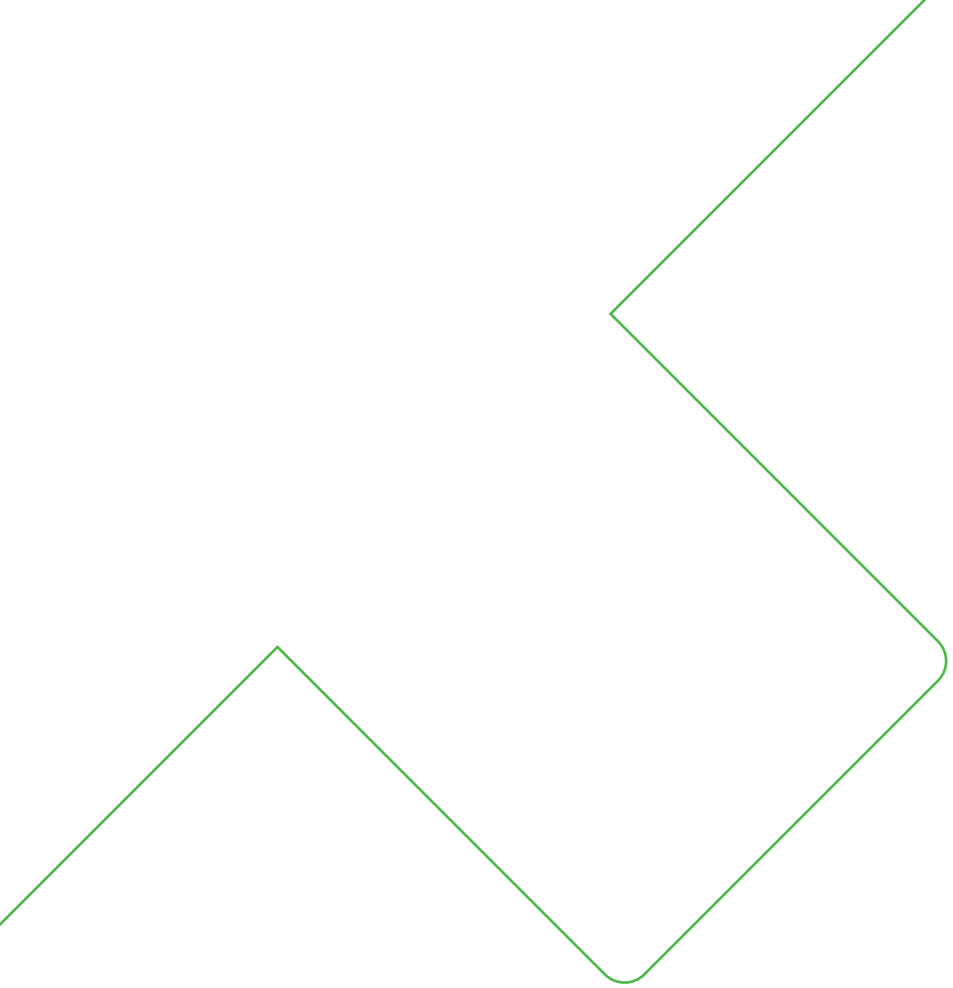
Positon 2: Oil-ppmcal

Contact and provide E+E HQ the datasheet of the oil before sending us 2 litres of oil.

Accessories

For further information see datasheet [Accessories](#).

Accessories	Code
Modbus configuration adapter	HA011018
E+E Product Configuration Software (Free download: www.epluse.com/pcs10)	PCS10
M12 Y adaptor	HA030204
Protection cap M12 socket	HA010781
Protection cap M12 plug	HA010782
Ball valve G 1/2" ISO	HA050101
Ball valve 1/2" NPT	HA050104
Sampling cell with shut-off function, PN40, DN25	HA050109



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